Contr. Univ. Michigan Herb. 25: 225–230. 2007.

CAREX MICHOACANA, A NEW SPECIES OF CAREX SECTION OVALES (CYPERACEAE) FROM MEXICO

Anton A. Reznicek
University of Michigan Herbarium
3600 Varsity Drive
Ann Arbor, Michigan 48108-2287

Andrew L. Hipp
The Morton Arboretum
4100 Illinois Route 53
Lisle, Illinois 60532

M. Socorro González-Elizondo
CIIDIR, Instituto Politécnico Nacional
Apartado Postal 738
Durango, Dgo., 34000, Mexico

Abstract. *Carex michoacana* is described as new from Michoacán, Mexico. It is most similar morphologically to *C. tetrastachya* from the southern United States, but differs in having smaller perigynia with narrower achenes. It differs from all other species in the *Carex brevior* group with similarly large perigynia in having staminate and pistillate scales with a scabrous awn formed by the excurrent midvein and perigynia nerveless over the achene adaxially. From a molecular phylogenetic standpoint, the position of this species is equivocal, but the more conclusive of the two nuclear ribosomal DNA datasets utilized supports the morphological evidence suggesting that it is a member of the *Carex brevior* group. The names *C. tetrastachya* and *C. brittoniana* are typified.

CAREX MICHOACANA

Carex sect. *Ovales* is a large and difficult section of ca. 90 species that is predominantly North American, but with a number of species also in mountainous areas of the neotropics (Hipp et al. 2006). The group is complex, but relatively well understood in Mexico, with 13 species recognized by Reznicek (1993). Field work for the Flora del Bajío area has disclosed an unusual new species of sect. *Ovales*, known only from a single collection. It is morphologically most similar to *C. tetrastachya* of the southern United States, but quite distant geographically; the type locality in Michoacán is ca. 900 km southwest of the nearest occurrence of *C. tetrastachya*.

Carex michoacana Reznicek, Hipp & S. González, sp. nov.—Type: Mexico. Michoacán: Mpio. Angamacutiro, lugares cercanos a la cortina de la presa El Rosario, 1750 m, 8 May 2005, *Rzedowski 54150* (holotype: IEB!; isotypes: CIIDIR! MICH!). Fig. 1.

Plantae laxe caespitosae; culmi fertiles 55–83 cm alti. Folia 5–8; laminae 2–30 cm longae, 1.5–3.1 mm latae; vaginae ca. 3–8 mm longae, ventraliter albido-hyalinae, glabrae; ligulae 3.2–6.8 mm longae. Inflorescentiae 2.5–3.8 cm longae; spicae gynaecandrae, ovoideae, 9–14 mm longae, 8.5–11.5 mm latae. Squamae pistillatae anguste ovatae, albo-hyalinae, 1-nervatae, 3.8–4 mm longae, 1.5–1.7 mm latae, aristatae costa

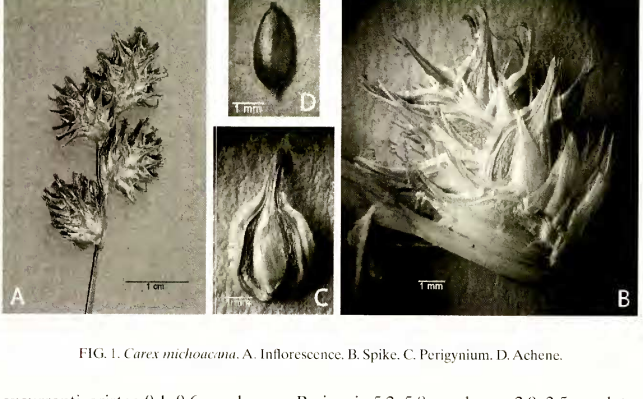

FIG. 1. *Carex michoacana*. A. Inflorescence. B. Spike. C. Perigynium. D. Achene.

excurrenti, aristae 0.1–0.6 mm longae. Perigynia 5.2–5.8 mm longa, 2.9–3.5 mm lata, 1.6–1.8plo longiora quam latiora, patentia, planoconvexa, corporibus late ellipticis vel orbiculatis, 3.6–4 mm longis, 1–1.2plo longioribus quam latioribus, in rostrum serrulatum 1.4–1.9 mm longum contracta. Achenium 2.4–2.7 mm longum, 1.1–1.35 mm latum, biconvexum. Styli marcescentes; stigmata 2. Antherae 3, ca. 1.5–2.2 mm longae.

Loosely cespitose in small clumps from short, thick, woody rhizomes; rhizomes elongating with age; fertile culms ca. 55–83 cm tall, erect, trigonous, sometimes flattened below, sparsely scabrous-angled below inflorescence; bladeless basal sheaths dark brown, disintegrating into short fibers. Leaves 5–8, on the lower 2/5–1/2 of the culm; blades 2–30 cm long, 1.5–3.1 mm wide, plicate or flat, glabrous, the margins and midrib antrorsely scabrous distally; leaf sheaths ca. 3–8 cm long, tightly enveloping culms, smooth, green, larger sheaths with the intervenal areas pale whitish green with scattered, more or less horizontal green septae on the upper portion; the inner band of sheaths glabrous, green with a prominent whitish hyaline zone, the apex concave, more or less equaling the base of the blade, whitish hyaline; ligules 3.2–6.8 mm long, obtuse, the free portion entire to finely erose and up to 0.4 mm long. Vegetative culms annual, few, fully developed only after perigynia are largely shed, ca. 12–15 cm tall with ca. 5–9 leaves mostly clustered near the summit of the culm. Inflorescences ca. 2.5–3.8 cm long, erect, the spikes overlapping or the lowermost slightly separate, the lowest spikes ca. 7–12 mm distant, spikes single at nodes, sessile; lowermost bracts bristle-like, ca. 0.8–5.4 cm long, often inconspicuous, sheathless, upper bracts much reduced; spikes 3–4 (5), gynecandrous, orbicular to ovoid with rounded bases or the uppermost with a short-clavate base, 9–14 mm long, pistillate portion 8–11 × 8.5–11.5 mm, ca. 20–40-flowered, staminate portion 1–3 × 1.5–2 mm, ca. 3–6-flowered. Pistillate scales 3.8–4 × 1.5–1.7 mm, ± reaching the base of the beak, narrowly ovate, acute, the midvein excurrent as a scabrous awn 0.1–0.6 mm long, whitish hyaline with a pale brown or stramineous, 1-veined center. Staminate scales ca. 3.8–4.4 × 1.6–2 mm, ovate, acute, the midvein excurrent as a scabrous awn 0.2–1.2 mm long, whitish hyaline with a pale brown or stramineous, 1-veined center. Perigynia glabrous, sessile, ca. 5.2–5.8 × 2.9–3.5 mm wide, 1.6–1.8 times as long as wide, ± spreading, herbaceous, ± translucent

over achene; bodies broadly elliptic or ± orbicular, 3.6–4 mm long, 1–1.2 times as long as wide, 1.9–2.7 times as long as the beak, and widest 1.6–2 mm above base, broadly thin-winged with wings 0.8–1.2 mm wide, finely serrulate-margined above the middle, contracted into a beak, yellowish green to stramineous with paler margins, nerveless adaxially and abaxially over the achene, 1–2-nerved in the wings; beaks 1.4–1.9 mm long, strongly flattened and serrulate-margined to apex, the apex bidentate with scabrous-margined teeth 0.6–1.1 mm long. Achenes 2.4–2.7 × 1.1–1.35 mm, 1.8–2.5 times as long as wide, biconvex, narrowly ovate to narrowly oblong, pale brown to brown, short-stipitate at base, apiculum 0.4–0.5 mm long; style straight; stigmas 2. Anthers 3, ca. 1.5–2.2 mm long.

With its very large perigynia with ± orbiculate bodies, *C. michoacana* resembles no known Mexican species of *Carex* sect. *Ovales* (except for *C. tetrastachya* Scheele, recently discovered in Coahuila; Mora-Olivo, unpubl.). In overall appearance, this species closely resembles a small individual of *C. tetrastachya,* and the details of vegetative features and perigynia and scales also are similar (sheaths smooth, with a prominent hyaline zone on the inner band, staminate and pistillate scales with a scabrous awn formed by the excurrent midvein, and very broad, ±orbicular perigynium bodies nerveless over the achene on both faces); however, *C. michoacana* has smaller, especially narrower, perigynia only 5.2–5.8 mm long and 2.9–3.5 mm wide, versus 5.5–8 (–8.7) mm long and 3.5–6 mm wide in *C. tetrastachya* and also distinctly narrower achenes 2.4–2.7 long, 1.1–1.35 mm wide, and 1.8–2.5 times as long as wide versus achenes 2–2.8 mm long, 1.4–2.2 mm wide, and 1–1.8 times as long as wide in *C. tetrastachya. Carex michoacana* differs from all other species in the *C. brevior* group of sect. *Ovales* (as used by Rothrock & Reznicek, 2001; see also Hipp et al., 2006) with large perigynia (routinely longer than 5 mm and with wide bodies) and smooth sheaths with which it might be confused (*C. opaca* (F. J. Herm.) P. Rothr. & Reznicek, *C. missouriensis* P. Rothr. & Reznicek, *C. shinnersii* P. Rothr. & Reznicek, and *C. hyalina* Boott) in having staminate and pistillate scales with a scabrous awn formed by the excurrent midvein, perigynia nerveless over the achene adaxially, and narrow achenes (except for *C. hyalina*, which has achenes 1.6–2 times as long as wide but only 0.9–1.2 mm wide).

From a molecular phylogenetic standpoint, placement of this species is equivocal. Total genomic DNA was extracted from one individual of *C. michoacana* (*Rzedowski 54150*, MICH) and sequenced for the nuclear ribosomal DNA external transcribed spacer (ETS; GenBank accession EF635436) and internal transcribed spacer (ITS; GenBank accession EF635435) regions. A new ETS sequence was also generated for *C. tetrastachya* (*Reznicek 10411*; GenBank accession EF681761). Sequences were analyzed in conjunction with previously published sequences for sect. *Ovales* using the Bayesian method implemented in MrBayes 3.0b4 (Huelsenbeck & Ronquist 2001). Taxa analyzed included all members of the eastern North American clade identified in previous research on the group (Hipp et al. 2006) and a subsample of western North American taxa.

Sequence data from the ETS region place *C. michoacana* within a strongly supported clade composed of *C. brevior* (Dewey) Mack. ex Lunell, *C. hyalina*, *C. molestiformis* Reznicek & P. Rothr., *C. reniformis* (L. H. Bailey) Small, *C. shinnersii*, and *C. tetrastachya* (posterior probability = 0.97; Fig. 2). The sequence for *C. michoacana* differs from that of all other species in the clade by at least three base pairs, and in fact the sequence is less similar to *C. tetrastachya* than *C. tetrastachya* is to *C. reniformis* and *C. molestiformis*. Likewise, the ITS sequence for *C. michoacana* differs from all other ITS sequences analyzed by at least nine base pairs; however, ITS data

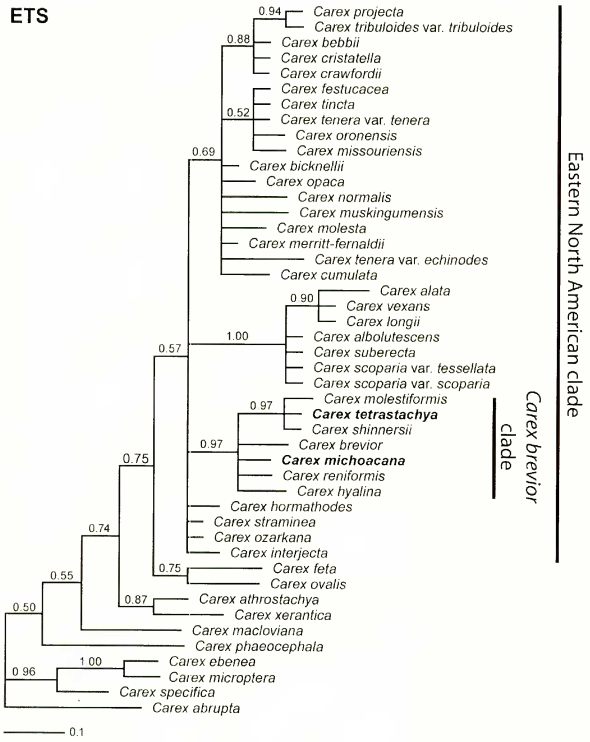

FIG. 2. Majority-rule consensus of trees retained in Bayesian analysis of the external transcribed spacer region of nuclear ribosomal DNA. Posterior probability estimates are indicated above the branches.

suggest a phylogenetic position for this species outside of the well supported core group of eastern North American taxa ("ENA I," posterior probability = 1.00; Fig. 3) that includes the *Carex brevior* clade. Combined analysis of the two datasets with *C. michoacana* included (not shown) breaks up the *Carex brevior* clade, places *C. michoacana* sister to ENA I, and embeds the western North American and Eurasian taxa *C. feta* L. H. Bailey and *C. ovalis* Gooden. within the broader eastern North American clade. These rearrangements stand at odds with previous, strongly supported results (Hipp et al. 2006). Incongruence between ITS and ETS is not uncommon in much of *Carex* subg. *Vignea* (Ford et al. 2006), but it is rare in sect. *Ovales*. Pending further study, the best estimate of the phylogenetic position of *C. michoacana* is within the *Carex brevior* clade, based both on morphology and the ETS tree.

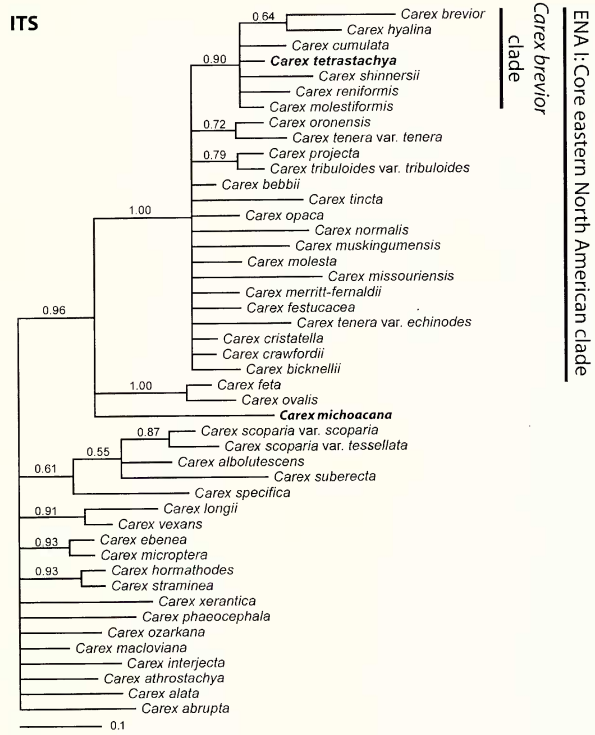

FIG. 3. Majority-rule consensus of trees retained in Bayesian analysis of the internal transcribed spacer region of nuclear ribosomal DNA. Posterior probability estimates are indicated above the branches.

NEOTYPIFICATION OF CAREX TETRASTACHYA

The name *Carex tetrastachya* was published by Scheele based on a collection that Carl Ferdinand von Roemer gathered near New Braunfels, Comal County, Texas. The whereabouts of Scheele's herbarium is unknown, and inquiries to find original Roemer material have been fruitless. Although the specimen Scheele saw was obviously very immature, he clearly described diagnostic features of *C. tetrastachya,* including the typically four spikes, the whitish hyaline, 1-veined scales, and the awn formed by the excurrent midvein. The application of the name is clear, and it has been used in *Flora of North America* (Mastrogiuseppe et al. 2002), *Illustrated Flora of East Texas* (Diggs et al. 2006), and a number of recent papers.

Carex tetrastachya ranges from southwestern Louisiana to west-central and southernmost Texas, and easternmost Coahuila, Mexico, north to southernmost Oklahoma. Stanley D. Jones (pers. comm.) noted that *C. tetrastachya* is variable. Material from the western, drier portion of its range tends to have more spreading perigynia at maturity, with longer beaks, and more eastern material has shorter, more appressed beaks. Preliminary study of this variation is consistent with it being clinal, but it only seems prudent to select a neotype from the western portion of the range of the species, where New Braunfels is located, and which clearly shows the awned scales and typically four spikes, matching the protologue.

Carex tetrastachya Scheele, Linnaea 22: 347. July 1849, non *Carex tetrastachya* Traunst., Flora 33(23): 366. 21 June 1850.—Type: U.S.A. Texas: McCulloch Co., 3.1 mi WSW on FR 2028 (W 17th St.) from its jct. with US 87 in Brady, 1700 ft, 7 May 1993, *S. D. Jones 10008 with J. K. Wipff & S. D. Hatch* (neotype, here designated: MICH!; isoneotypes: GH! NY! TEX!).

Carex brittoniana L. H. Bailey in J. M. Coulter, Contr. U.S. Natl. Herb. 2(3): 484. 1894. *Carex straminea* var. *maxima* L. H. Bailey, Proc. Amer. Acad. Arts 22: 150. 1886.—Type: U.S.A. Texas. "Collected in expedition from western Texas to El Paso, New Mexico, May–October 1849," *C. Wright 719* (lectotype, here designated: GH! barcode 00027497; probable isolectotype: GH! barcode 00027496).

Carex straminea var. *prorepens* Kük., Das Pflanzenreich IV, 20(Heft 38): 208. 1909.—Type: U.S.A. Texas, *Lindheimer* (holotype: B, destroyed; isotypes not located).

Note: *Wright 719* was also the collection upon which the *nomen nudum Carex wrightii* S. T. Olney was based (not *C. wrightii* Dewey ex Torr., Bot. Mex. Bound. 232. 1859, nor *C. wrightii* Franchet, Bull. Soc. Philom. Paris 7:47. 1895).

LITERATURE CITED

Diggs, G. M., B. L. Lipscomb, M. D. Reed, and R. J. O'Kennon. 2006. Illustrated flora of East Texas. Sida, Bot.Misc. 26: 1–1594.

Ford, B. A., M. Iranpour, R. F. C. Naczi, J. R. Starr, and C. A. Jerome. 2006. Phylogeny of *Carex* subg. *Vignea* (Cyperaceae) based on non-coding nrDNA sequence data. Syst. Bot. 31: 69–81.

Hipp, A. L., A. A. Reznicek, P. E. Rothrock, and J. A. Weber. 2006. Phylogeny and classification of *Carex* section *Ovales* (Cyperaceae). Intern. J. Pl. Sci. 167: 1029–1084.

Huelsenbeck J. P., and F. Ronquist. 2001. MrBayes: Bayesian inference of phylogeny. Bioinformatics 17: 754–755.

Mastrogiuseppe, J., P. E. Rothrock, A. C. Dibble, and A. A. Reznicek. 2002. *Carex* section *Ovales*. In *Flora of North America*, ed. Flora of North America Editorial Committee, 23: 332–378. New York, Oxford: Oxford University Press.

Rothrock, P. E., and A. A. Reznicek. 2001. The taxonomy of the *Carex bicknellii* group (Cyperaceae) and new species for central North America. Novon 11: 205–228.

Reznicek, A. A. 1993. Revision of *Carex* Section *Ovales* (Cyperaceae) in Mexico. Contr. Univ. Michigan Herb. 19: 97–136.